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Applying the "Novosel formula", Comment on: Gaetano D. Gargiulo: "True Unipolar ECG Machine for Wilson Central Terminal Measurements"

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LETTER TO THE EDITOR

In a publication from 2015, Gaetano D. Gargiulo (1) describe a novel device for the ECG recordings with various parameters, which were used for the sophisticated analysis of the ECG recordings – in this particular, he analyse and discuss the concept of the Wilsnon Central Terminal (2), including as a minor topic the estimation of the mean electrical axis of the heart. On page 5 of his paper (1), he refer to our earlier publication (3), which addresses the fundamental aspects of calculating the heart's mean electrical axis in the frontal plane. These aspects were independently assessed in other studies (4, 5) and further discussed in our subsequent publications (6, 7, 8). Here we intuitively assume (1) that $\tan^{-1}$ (as frequently used) is an arctan function, and not 1/tan as semantically defined.

The following equation was published (1):

$$Cardiac\ Axis = \pm \arctan\left(\frac{aVF}{I}\right)$$

In the following, this equation was extended to:

$$Cardiac\ Axis = \pm \arctan \frac{((LLI) - (RA + LA)/2)}{(LA - RA)}$$

Our research (3) resulted in a different equation:

$$Cardiac\ Axis = \pm \arctan\left(\frac{2 * aVF}{(\sqrt{(3)} * I)}\right)$$

As we reported previously (7), the topic of the estimation of the electrical axis of the heart is still a challenging one. Among others, Dahl R and Berg R. (5) analyse our approach and found it grounded what we discussed elsewhere (6). We are convinced that this subject should not be ignored because of a methodological perspective. It is clear for us, that in a clinical, dally practice, the differences which results of our correction may not play any significant role.

Consequently, if applied in an automatic way – e.g., implemented in the hardware / software of the ECG devices, we see no rational argument not to apply the corrected

method (3). To our best knowledge, Gaetano D. Gargiulo (1) used the equation which did not correspond to the reports available at that time and should be reconsidered – or at least discussed. According to equations (7), the axis could be calculated, for example, from the combination of limb leads I and II. The equation delineated would be:

$$Cardiac\ Axis = \pm \arctan\left(\frac{2}{\sqrt{(3)}}\left(\frac{II}{I} - 0.5\right)\right)$$

Introducing the relationships between leads (7) and including them in the delineations of the previous equation (1), the formula used by Gaetano D. Gargiulo (1) seems to us to be incorrect. Summarizing our findings, we conclude that despite extensive and in-depth research, as well as accumulated knowledge about calculating the electrical axis of the heart, this subject deserves to be followed and remains challenging.

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